

FLIGHT PLANNING IN INTEX-A



The DC-8 at MidAmerica airport

FROM MISSION DESIGN TO DAY-TO-DAY FLIGHT PLANNING

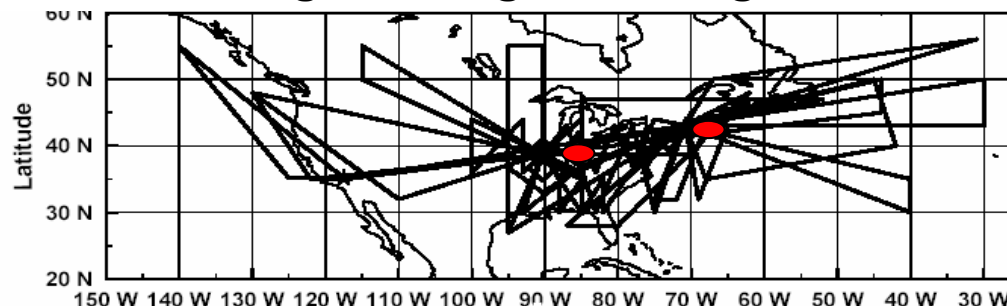
INTEX-A mission objectives

A priori information:

- *past observations*
- *models*

Observational resources

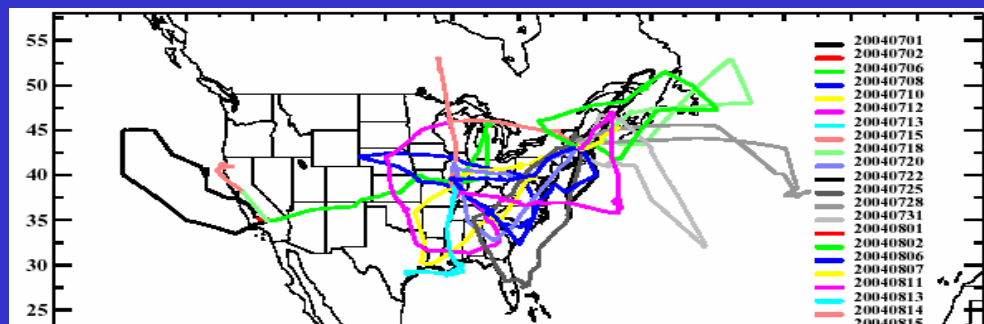
Mission design: timing, sites, flight menu



INTEX-A
pre-mission
flight plan

Get in the field; throw away the plans

day-to-day flight planning



Actual
flight plan

HOW WAS DAY-TO-DAY FLIGHT PLANNING DONE?

- **MIND THE VISION:** mission objectives, evolving priorities, flight menu
- **IDENTIFY OPPORTUNITIES:**
 - Near-real-time observations (aircraft, satellite)
 - Synoptic meteorological forecasts
 - Plans of other ICARTT aircraft
- **DESIGN FLIGHT PLAN:**
 - Lagrangian trajectories
 - Forward: track current events of interest
 - Backward: define areas of influence for proposed flight tracks
 - Eulerian CTMs: convolve meteorological forecasts with source and chemical information; fly aircraft through model
- **GENERAL FLIGHT PLAN CRITERIA:**
 - Satellite validation (Terra, Aqua, Envisat)
 - Extensive vertical profiling
 - Extensive geographical coverage

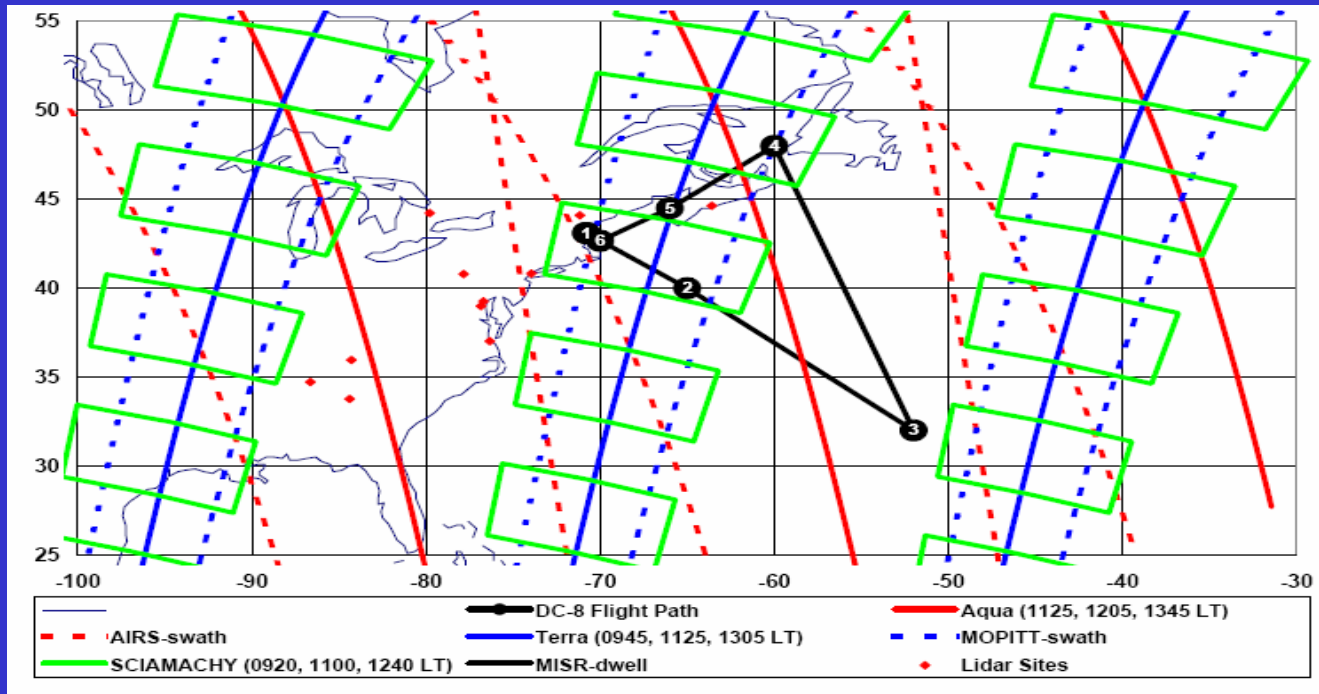
FLIGHT PLANNING TEAM AND PRODUCTS

- **Fuelberg:** weather forecasts, forward trajectories (boundary layer influence), back-trajectories (potential flight tracks)
- **Thompson/Pickering/Pfister:** forward trajectories, Lagrangian influence maps (ozonesondes, TOMS AI, lightning, convection)
- **McMillan:** NRT AIRS CO + forward trajectories
- **Richter:** NRT SCIAMACHY NO₂, HCHO
- **Chu:** NRT MODIS AOD, NOAA GASP AOD, smoke product
- **Edwards/Emmons:** MOPITT CO + MOZART global CTM forecasts
- **Carmichael:** STEM regional CTM forecasts
- **Pierce:** RAQMS global CTM forecasts
- **Jacob/Jaegle/Pawson:** GEOS-4 global CTM forecasts
- **Crawford:** flight planning and satellite orbit software

INTEX flight#14 plan – Pease local 6 on 7/31

Objectives:

1. Low-level continental outflow
2. Chemical aging and recirculation around Bermuda High
3. Intercomparison with P-3
4. Triple-whammy satellite validation: Terra, Aqua, Envisat



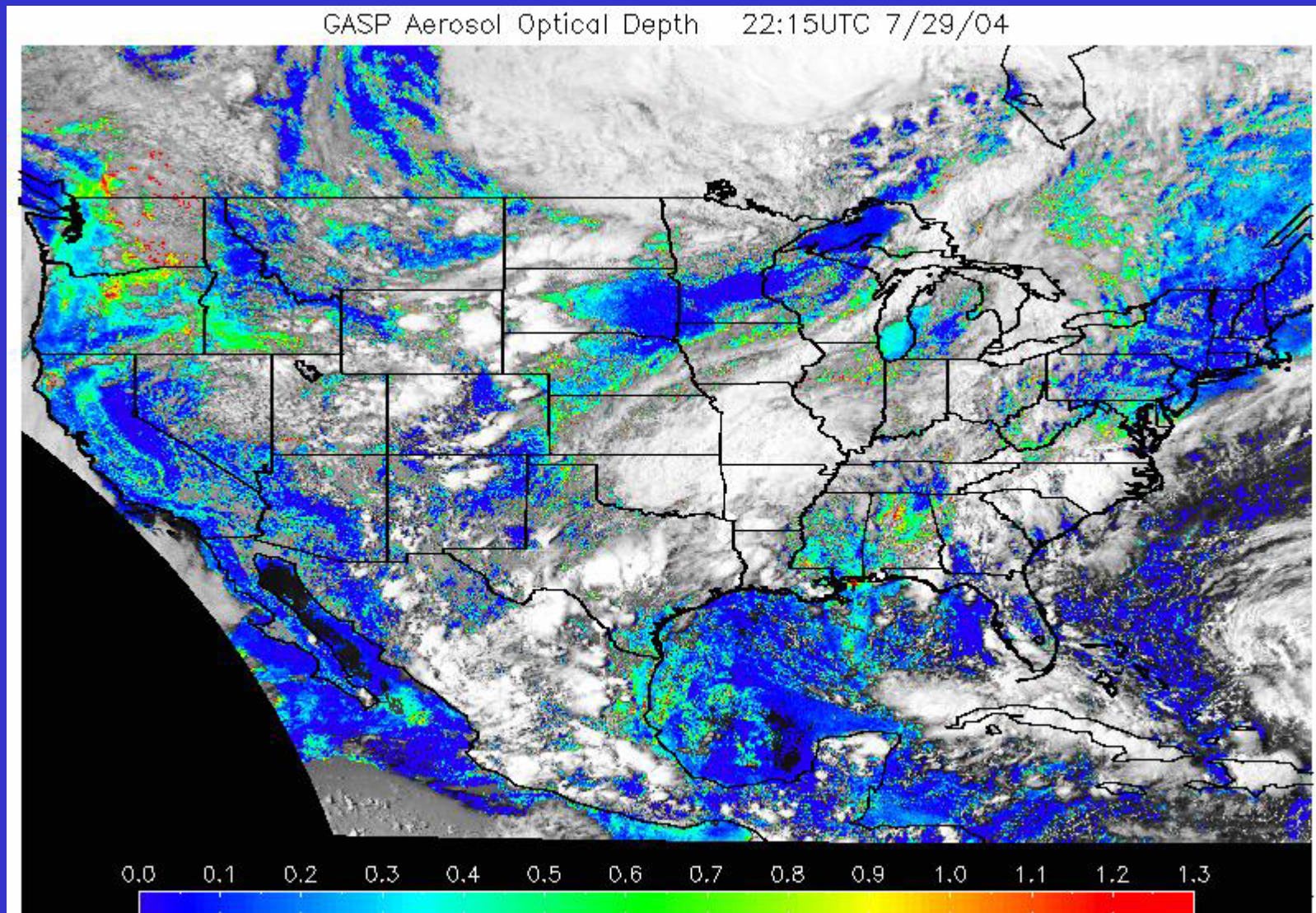
Full vertical profiling along points 1-2-3-4;

Spiral at point 2 (satellite validation);

Low-altitude 1-15K legs along points 4-5;

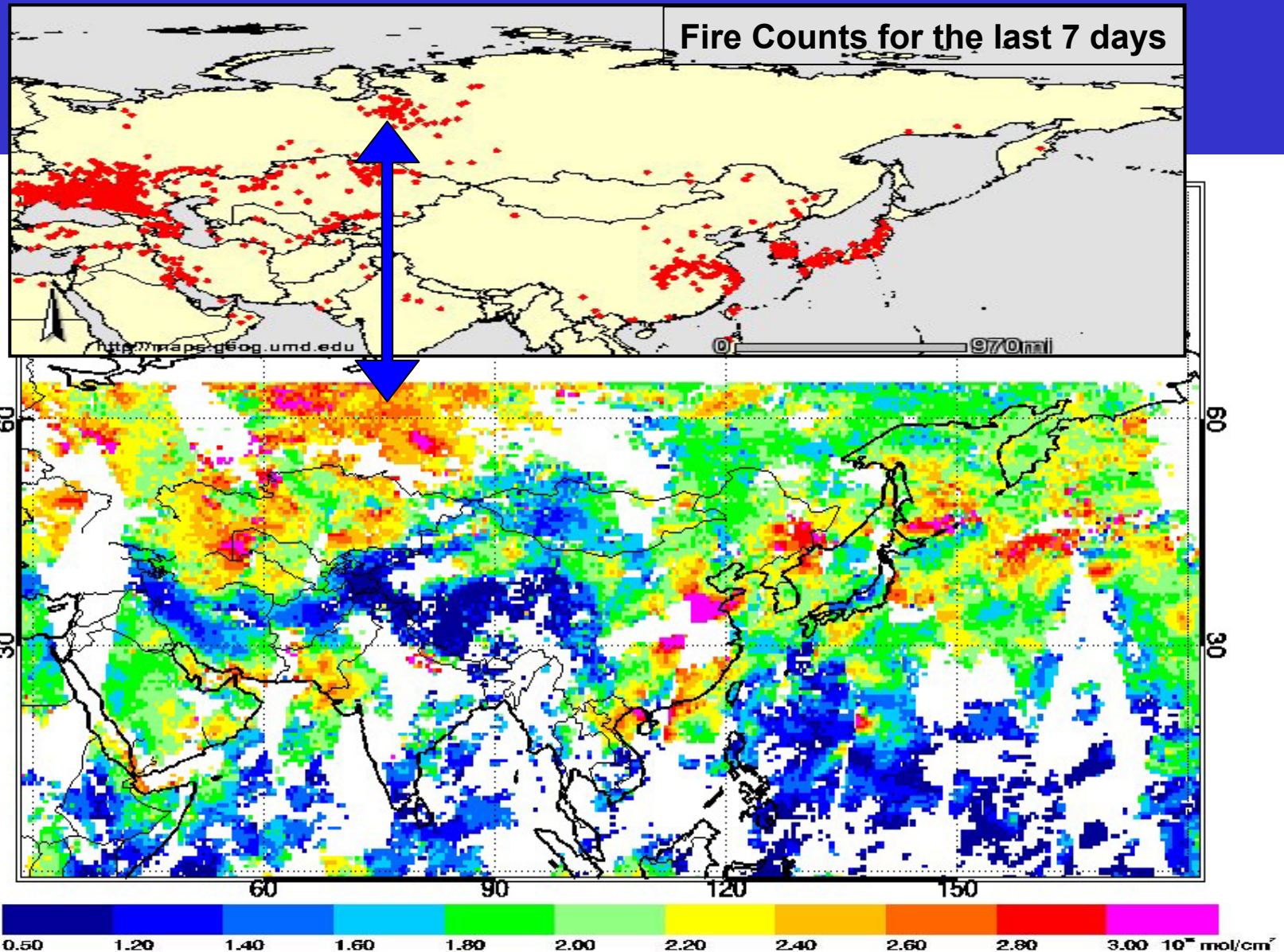
P-3 rendez-vous at point 5, intercomparison along points 5-6

NOAA GASP AOD and Fire and Smoke 7/29 at 22Z: Fires in Washington State



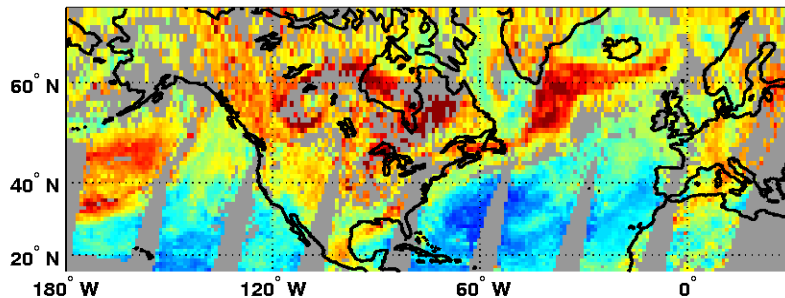
Fires in western Siberia

MOPITT CO Column for 20040725-20040729

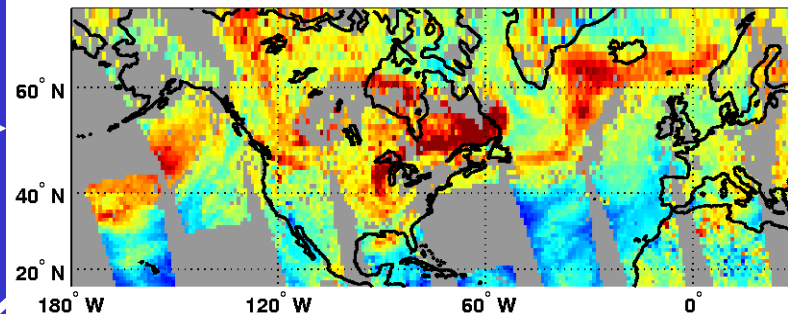


AIRS CO mixing ratio on 7/27-29: Elevated CO transported over to the Atlantic Ocean, Asian plume reaching west coast

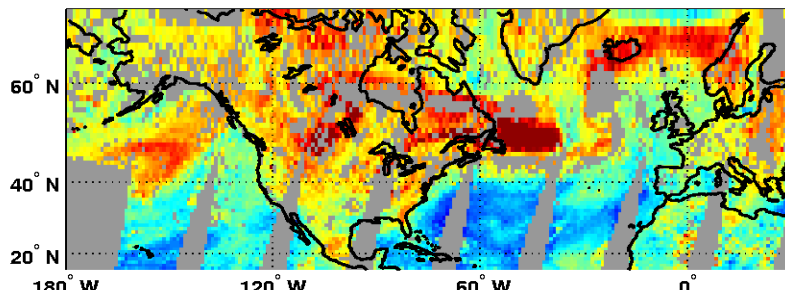
Local AM (descending) AIRS CO at 500 mb on 20040727



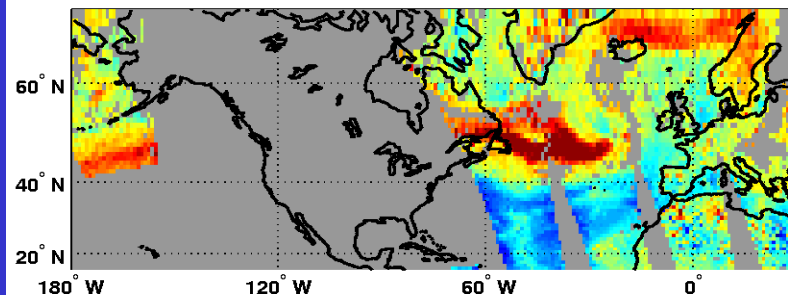
Local PM (ascending) AIRS CO at 500 mb on 20040727



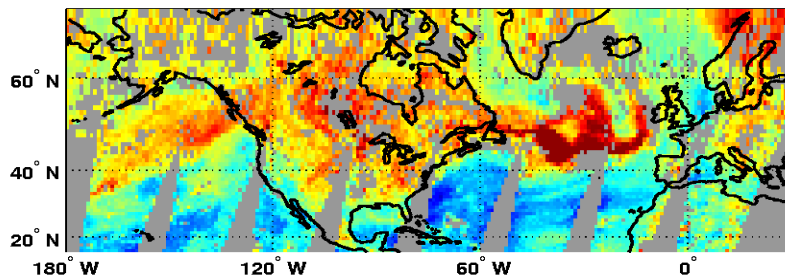
Local AM (descending) AIRS CO at 500 mb on 20040728



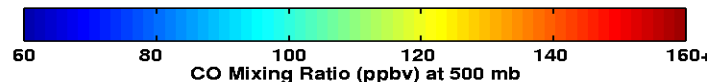
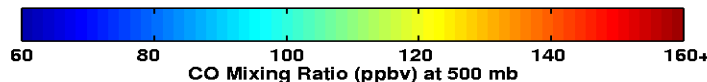
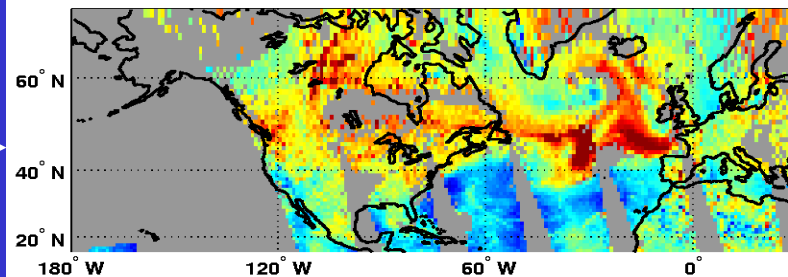
Local PM (ascending) AIRS CO at 500 mb on 20040728



Local AM (descending) AIRS CO at 500 mb on 20040729

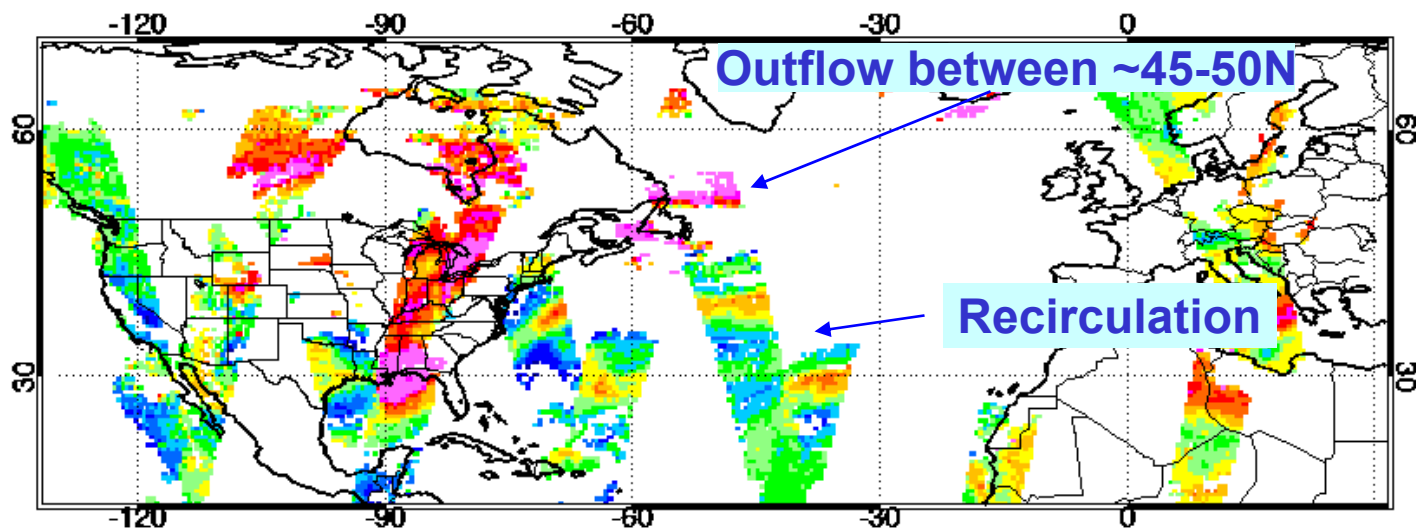


Local PM (ascending) AIRS CO at 500 mb on 20040729

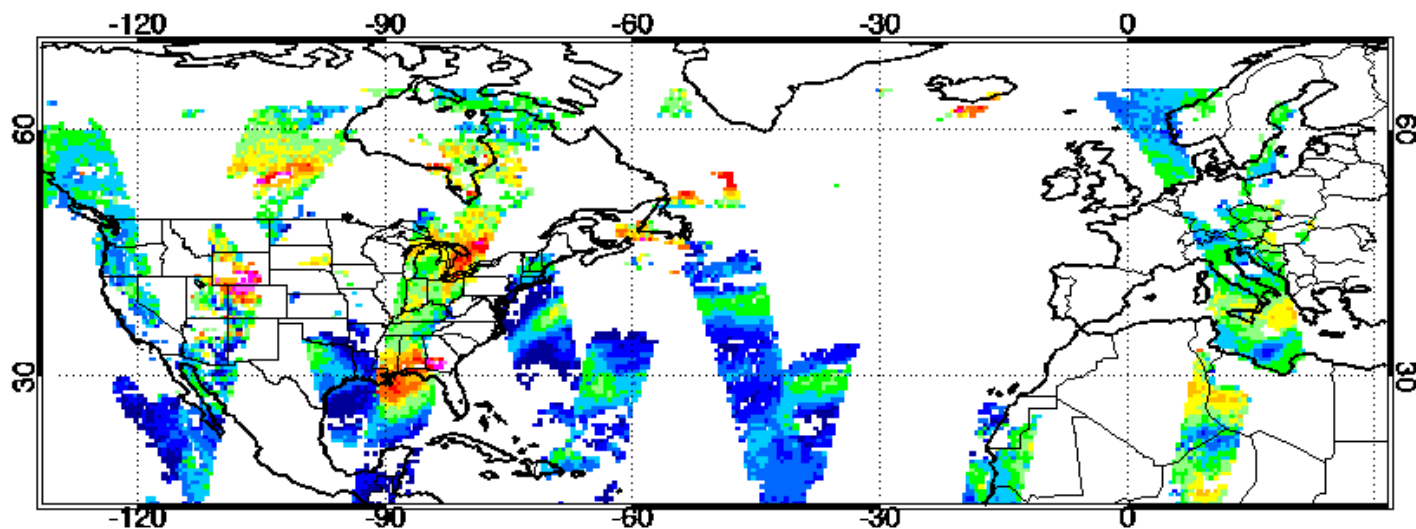


MOPITT CO for 20040728

MOPITT CO (V3) Column Jul 28, 2004

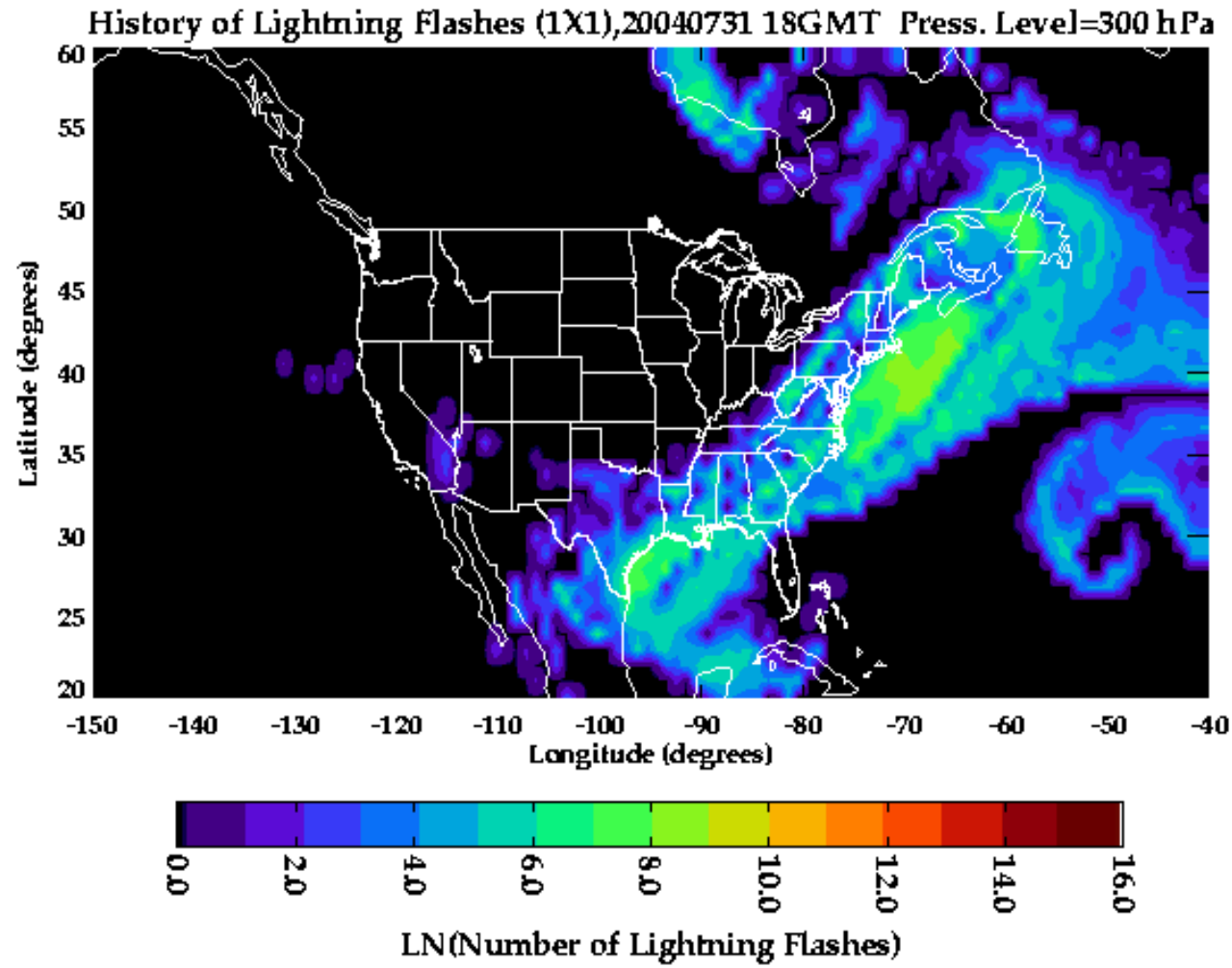


MOPITT CO (V3) 700hPa Jul 28, 2004



Gridded at 0.5x0.5deg from MOP02F-20040728-L2V6.1.2.prov.hdf (apriori fraction < 50%)

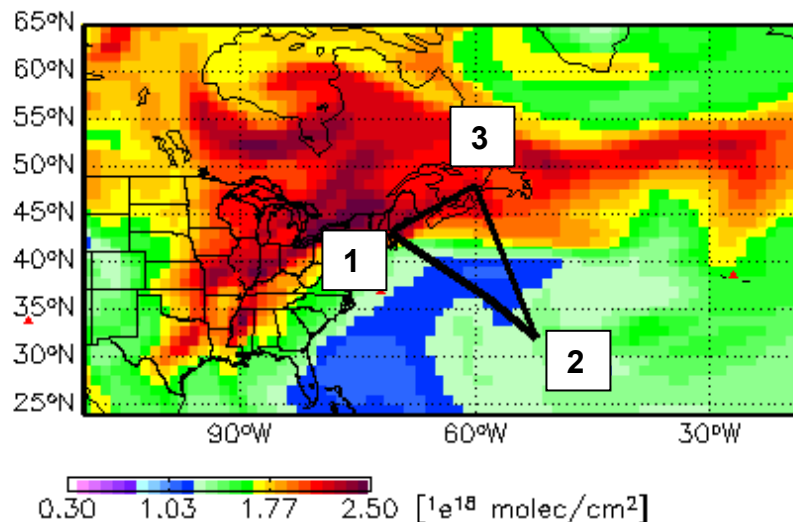
Lightning Influence over 5 days maximum SE of New England Coast



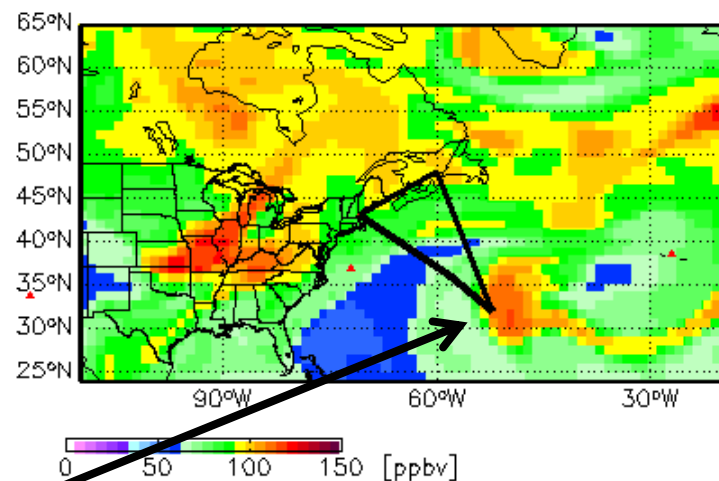
NAS A/GSFC/916/kinetic/TK

**GEOS-4 7/29 12Z forecasts for 7/31 18Z:
low-altitude outflow, high-altitude recirculation**

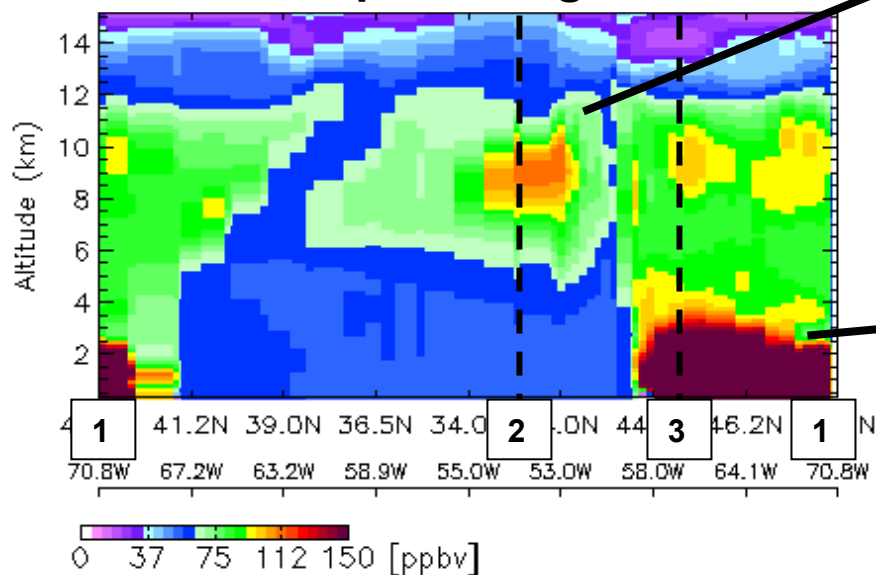
CO column



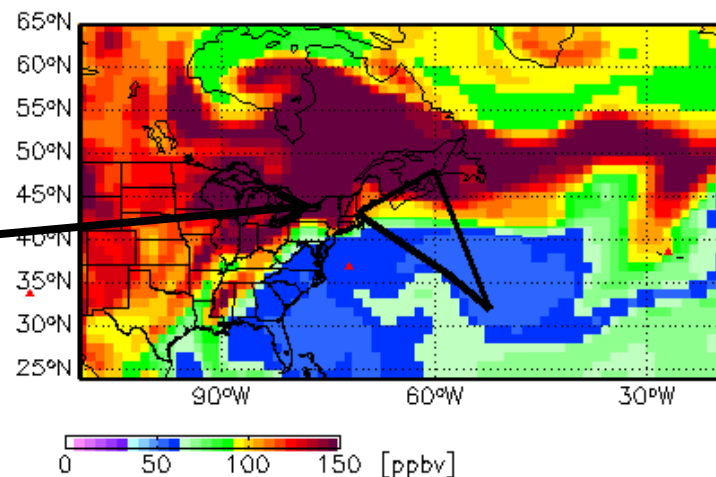
CO at 300 hPa



CO curtain plot along flt. track

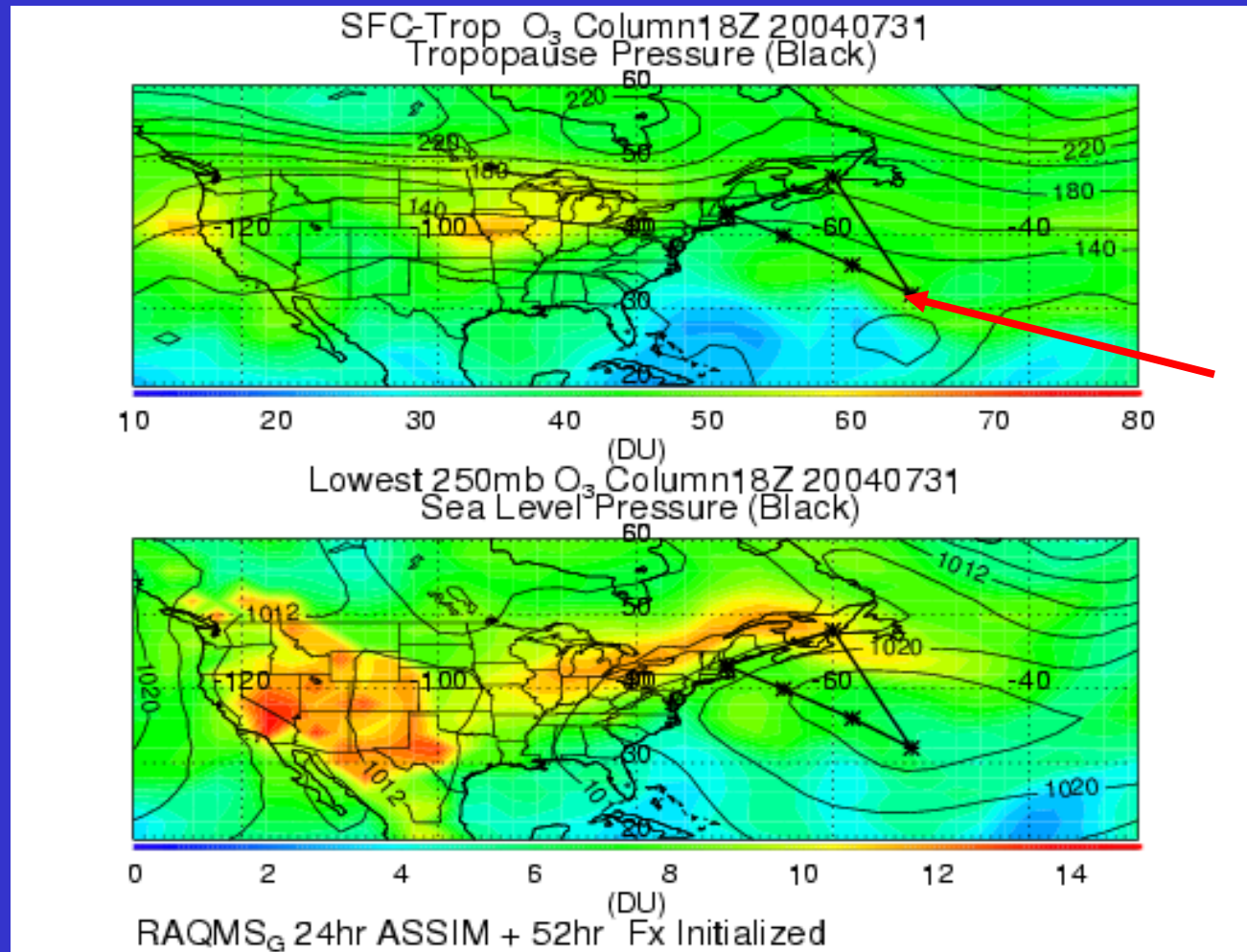


CO at 800 hPa



RAQMS 54hr fx valid 07/31 18Z

Tropospheric O₃ columns



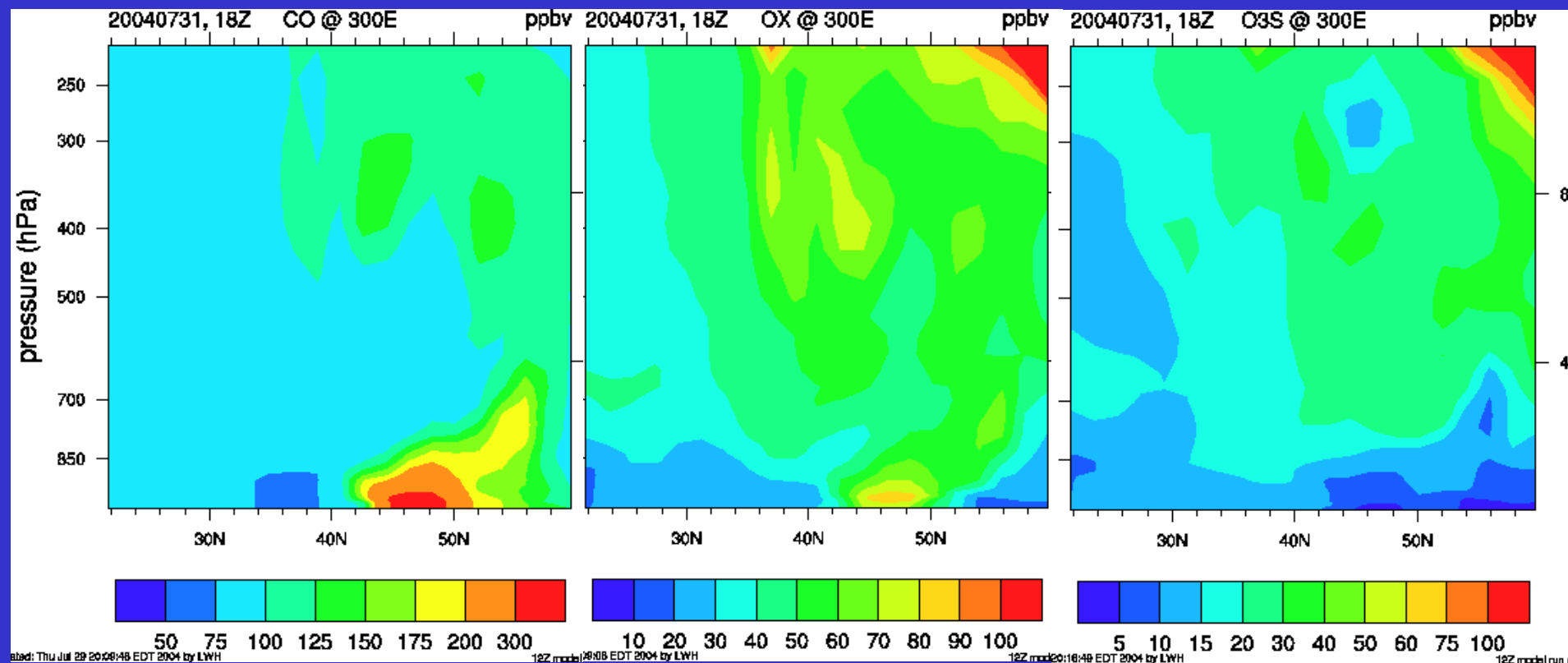
Recirculated
air in
Bermuda
High

MOZART-2 Forecast for 20040731/18Z, Cross Section 60W: low-altitude outflow at 45-50N

Total CO

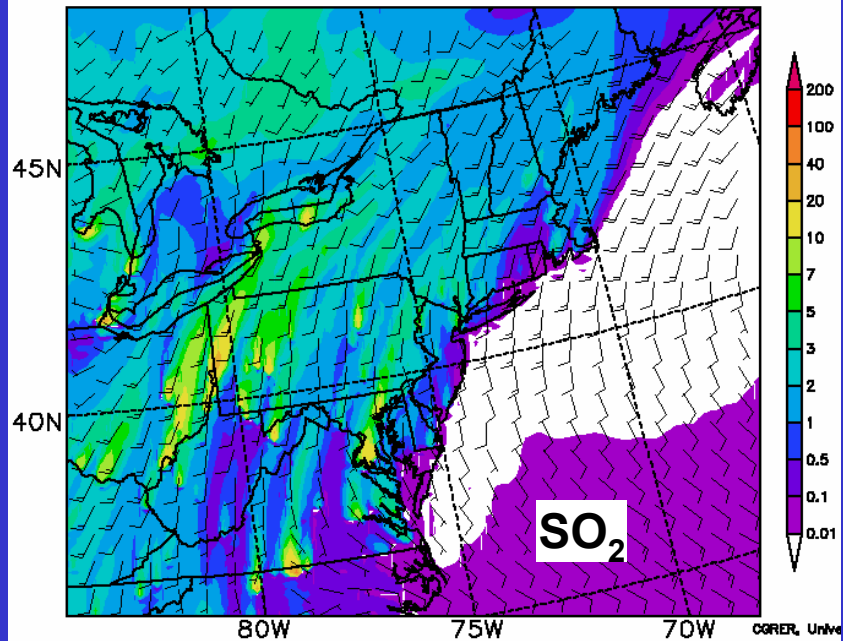
Total O3

Strat. O3

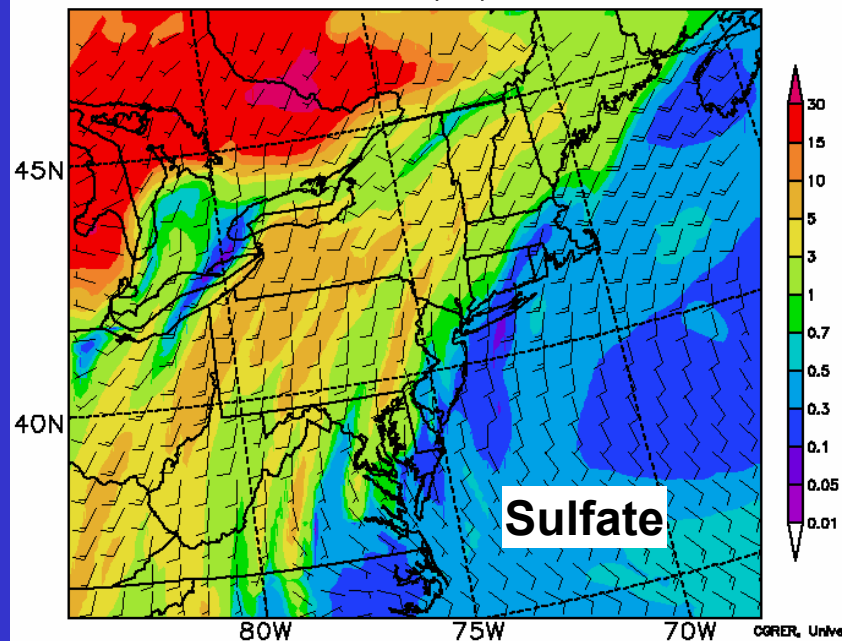


Forecast from 20040729/12Z

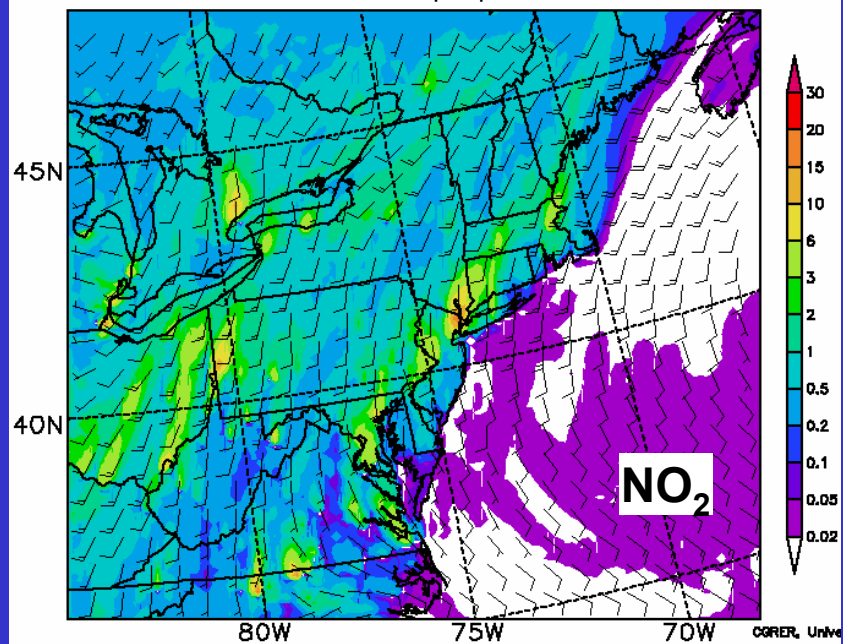
Simulated SO_2 (ppbv) in the 400m layer
at 21GMT, 07/31/2004



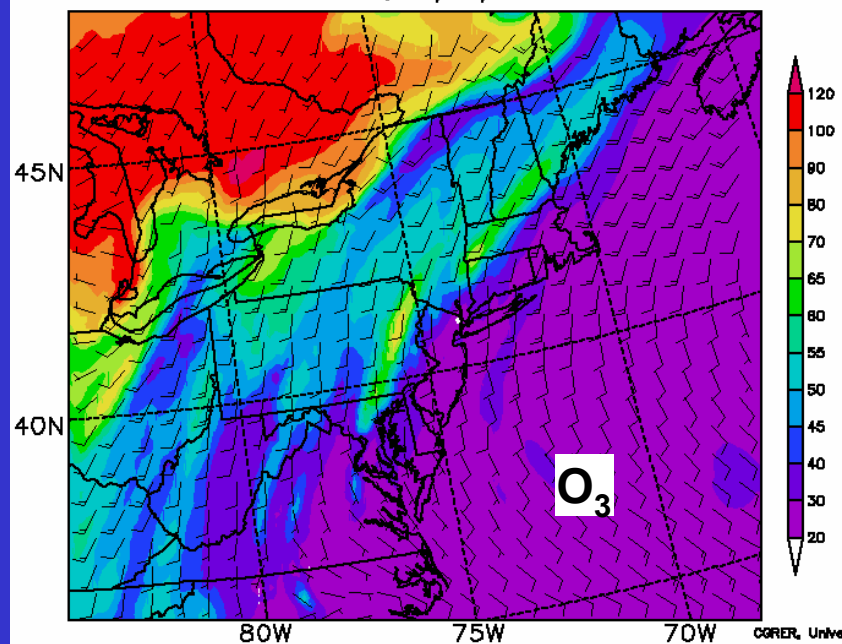
Simulated Total Sulfate ($\mu\text{g}/\text{std m}^3$) in the 400m layer
at 21GMT, 07/31/2004



Simulated NO_2 (ppbv) in the 400m layer
at 21GMT, 07/31/2004



Simulated O_3 (ppbv) in the 400m layer
at 21GMT, 07/31/2004



MODEL-GUIDED FLIGHT PLANNING, MODEL-ASSISTED DATA ANALYSIS

- Flights designed to test models targeted at INTEX-objectives – models in broadest sense! statistical relationships, conceptual models, 0-D, 3-D
- 3-D models are versatile tools – integrate them in data analysis. The modelers don't have to be in the driver's seat!
- Integration of multi-platform aircraft observations, satellite observations, and 3-D models offers a powerful approach for addressing INTEX-A objectives.